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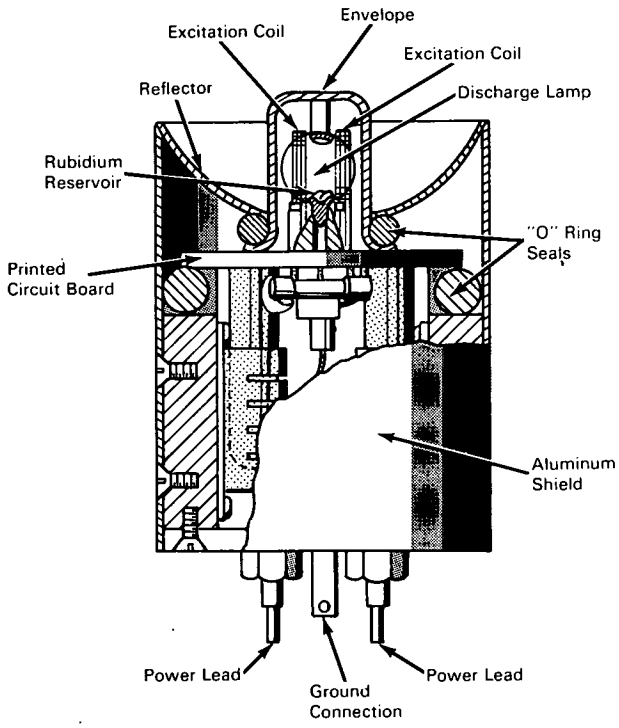
Electrodeless Discharge Lamp Is Easily Started, Has High Stability



The problem: Electrodeless discharge lamps have recently come into use in various high-resolution optical systems. Two disadvantages encountered have been difficulty in starting (excitation) of the lamps and self-reversal of spectral lines at the higher frequencies due to discharge transfer between the filling gas and the alkali vapor.

The solution: An electrodeless discharge borosilicate glass lamp, partially charged with the noble gas, krypton, and containing a small amount of rubidium, enclosed in a hermetically sealed envelope that maintains the lamp at an optimum temperature during discharge. The lamp is quickly started by its excitation coil, whose inside-out configuration establishes a very strong electric field.

How it's done: The lamp is mounted between the two halves of its excitation coil inside a hermetically sealed glass envelope or dome that assures optimum discharge temperature. These components penetrate the center of a parabolic reflector.

(continued overleaf)

The alkali metal used for the vapor discharge is 1 mg of rubidium in a filling gas of krypton at 2 mm Hg. These components are mounted, with appropriate spacers, O-ring seals, and cement, to a copper-clad, glass epoxy printed circuit board, whose underside mounts a self-regulated, constant current oscillator circuit that drives the excitation coil. The entire lamp-oscillator assembly is held in a snugly fitting aluminum sleeve and is tightly cushioned against the reflector, enclosing the upper end of the sleeve, by an O-ring.

In operation, the temperature of the reservoir containing the alkali metal rubidium is maintained lower than that of the discharge region so that no condensation of vapor on the lamp walls or discharge-disturbing migration of metal particles take place.

Notes

1. This lamp has been successfully used for optical pumping in magnetometers, atomic clocks, and frequency standards.
2. This lamp is an efficient and stable source of high-resolution spectral line radiation with a very high signal-to-noise ratio.

Source: William E. Bell and
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